

4th, Ariz. 5th, Ariz., Tex. 7th, Kans. 9th, Pa. 10th, Mass. 12th, Tenn., Wash. 13th, Utah. 16th, Ala., N. J., S. C., Tenn. 17th, Ill., N. C., Ohio, Tenn. 18th, Cal. 19th, N. C., Oregon, Wash. 20th, N. Y., Oregon, Wash. 21st, Va., Wash. 22d, Cal., Utah, Va. 23d, N. Y., Wash. 25th, Kans. 26th, Ill., Md., Mo., Ohio. 27th, Mass., N. Y., Pa. 28th, Iowa, Kans., Me., N. Y., Vt. 29th, Mass., R. I.

SLEET.

Sleet was reported as follows: 1st, Wis. 2d, Nebr., N. Dak.

4th, Ariz., Ind. T., N. Y. 5th, Tex., Vt. 7th, Ind., Kans., Tenn., W. Va. 10th, Idaho, Me., N. H. 12th, Tex., Wis. 14th, Pa. 15th, Ohio, Pa., Tex. 16th, Ind., Ky., N. Y., N. C., S. C., Tenn. 17th, Ala., Ill., Ind., N. Y., Ohio, Tenn., Va., W. Va. 18th, Pa., Tenn., W. Va. 19th, Ga., Mont. 20th, Tex. 21st, N. Y. 22d, Utah. 23d, Conn., Wis. 25th, Conn., Kans., Utah. 26th, Ill., Ind., Kans., Mo., Ohio, Pa. 27th, Ill., Ind., Mass., N. H., N. Y., Pa., Tenn., Wis. 28th, Colo., Ga., Ill., Me., N. H., N. Y., Tenn., Vt. 30th, Wis.

WINDS.

The prevailing winds during November, 1889, are shown on chart ii by arrows flying with the wind. In New England, the middle Atlantic, south Atlantic, and east Gulf states, in the Ohio Valley and Tennessee, and the lower lake region, on the northeastern slope of the Rocky Mountains, and in the middle plateau region, the prevailing winds were westerly; in Florida, northerly; in the west Gulf states, the upper lake region, the extreme northwest, the upper Mississippi and Missouri valleys, and on the southeastern slope of the Rocky Mountains, north to northwest; over the northern plateau region, southeast to southwest; on the north Pacific coast, south to east; on the south Pacific coast, north to east; and in the Rio Grande Valley, on the middle-eastern slope of the Rocky Mountains, over the southern plateau region, and on the middle Pacific coast, variable.

HIGH WINDS (in miles per hour).

Maximum velocities of fifty miles, or more, per hour were reported at regular stations of the Signal Service as follows: Fort Canby, Wash., 88, s., 17th; 68, s., 25th; Wood's Holl, Mass., 63, se., 28th; Eastport, Me., 60, e., 28th; Block Island, R. I., 60, e., 28th; Winnemucca, Nev., 58, s., 22d; New London, Conn., 54, se., 28th; Galveston, Tex., 54, nw., 26th; Fort Elliott, Tex., 54, n., 20th; 50, n., 11th; Buffalo, N. Y., 52, sw., 3d; Fort McKinney, Wyo., 50, w., 22d.

LOCAL STORMS.

No severe thunder-storms were reported during the month.

Press reports state that a destructive storm moving from the southwest passed over New Berne, N. C., at 1 p. m. on the 21st, causing loss of life and considerable damage to property, and that on the 28th a destructive storm passed over the northern part of Beaufort Co., N. C., cutting a swath half a mile wide through timber, prostrating buildings, and causing considerable loss of life. During the 27th and 28th severe gales prevailed over the Lake region, New York, and New England. C. L. Bozzell, observer, Signal Corps, Sault de Sainte Marie, Mich., reports that high northeasterly winds, accompanied by fine, blinding snow, prevailed during the 27th

and 28th, with maximum wind velocity thirty miles per hour on the 28th; that the storm was unusually severe on the lakes, and that a number of vessels were wrecked. W. H. Andy, observer, Signal Corps, Marquette, Mich., reports that the wind increased to twenty-six miles per hour at 2.45 p. m., 26th, and was accompanied by light and heavy snow until the morning of the 28th; that the light-house was washed from its moorings, and considerable damage was done to the breakwater. H. L. Boyce, observer, Signal Corps, Port Huron, Mich., reports that a severe and almost continuous gale prevailed from the 26th to 30th, and that owing to the heavy snow it was the most dangerous experienced in that locality for years; maximum wind velocity thirty-four miles per hour at 8.05 a. m., 27th. T. F. Schley, observer, Signal Corps, Green Bay, Wis., reports that the wind reached a velocity of sixty miles per hour from the north on the 27th; that the gale was accompanied by snow, and that many disasters were reported on the lakes. S. W. Rhode, observer, Signal Corps, Milwaukee, Wis., reports that the northeast gale of the 27th and the northwest gale of the 28th, with maximum velocity thirty-seven and forty-two miles per hour, respectively, were quite severe, and caused very high seas on Lake Michigan; that a large number of vessels, with valuable cargoes, were ashore near "the straits;" that several serious disasters occurred off Chicago, and that none of the regular line steamers left the port of Milwaukee during those dates. H. C. Frankenfield, observer, Signal Corps, Chicago, Ill., reports that a severe gale prevailed throughout the day of the 28th, reaching a maximum velocity of thirty-seven miles per hour, and that numerous vessels were disabled on Lake Michigan. Dr. E. U. Jones, voluntary observer, Taunton, Mass., reports that a terrific gale prevailed at that place during the night of the 27-28th. Paul Daniels, observer, Signal Corps, New London, Conn., reports that a severe wind storm prevailed from the evening of the 27th to the morning of the 28th, with a maximum velocity of fifty-four miles per hour at 3.10 a. m., 28th, and that the tide was unusually high in the harbor during the day of the 28th. The snow storms of the month are referred to under the heading "Snow," in the chapter on "Precipitation."

INLAND NAVIGATION.

ICE IN RIVERS AND HARBORS.

The following notes relative to ice in rivers and harbors have been made by observers of the Signal Service:

Mississippi River.—La Crosse, Wis.: floating ice in river 18th to 20th, 24th, 25th, 27th, 29th, and 30th. The steam ferry boat "Warsaw" stopped running on the 29th, owing to ice. Saint Paul, Minn.: floating ice in river 16th, 17th, 24th, and 25th. The river was entirely gorged with ice on the 30th. Keokuk, Iowa: ice began running in the river on the 28th, and the steamer "Patience" laid up on that date, closing navigation for the season. Dubuque, Iowa: the river was full of floating ice on the 28th, and froze over on the 29th.

Missouri River.—Fort Buford, N. Dak.: floating ice in river 12th to 14th. The river froze over on the 15th, and remained

closed until the end of the month. Fort Yates, N. Dak.: the river was closed to navigation by ice on the 25th. Yankton, S. Dak.: the river froze over on the 27th, and navigation is closed for the season.

Red River of the North.—Saint Vincent, Minn.: the ferry boat laid up for the season on the 22d, on account of ice.

FLOODS.

Press reports state that the rivers at Johnstown, Pa., reached the danger-point and overflowed their banks on the 9th, causing considerable damage to railroad and other property. From the 17th to the 21st damaging floods and washouts, resulting from heavy rains, occurred at various points in Pennsylvania, New Jersey, and southern New York. The severe rain storm of the 27th and 28th resulted in serious washouts on railroads,

the overflow of many streams, and the destruction of mill and other property in New England, New Jersey, and Delaware.

STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the several stations; the highest and lowest water during November, 1889, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, Nov., 1889, (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.....	29.9		30	5	5.4	12.4
<i>Arkansas River:</i>						
Fort Smith, Ark....	22.0		28	2	1.6	8.0
Little Rock, Ark....	23.0		30	1	3.0	11.3
<i>Missouri River:</i>						
Fort Buford, Dak.....	15		1.1	7, 12, 13, 14	—0.3	1.4
Kansas City, Mo....	21.0		11	6.4	29	4.2
<i>Mississippi River:</i>						
Saint Paul, Minn....	14.5		5	1.9	24	1.1
La Crosse, Wis....	24.0		3.4	1.9	1, 8—12, 20, 21	1.7
Dubuque, Iowa....	16.0		13	2.0	4, 5, 29, 30	1.6
Davenport, Iowa....	15.0	12—16, 23, 24	0.9	30	0.6	0.3
Keokuk, Iowa....	14.0	10—12	0.4	5, 6, 7, 8, 29, 30	0.0	0.4
Saint Louis, Mo....	32.0	14	10.6	1	3.7	6.9
Cairo, Ill.....	20.0	23	28.9	1	4.2	24.7
Memphis, Tenn....	34.0	25	22.5	1, 2, 3	3.2	19.3
Vicksburg, Miss....	41.0	30	26.0	1, 2	—0.8	26.8

Heights of rivers—Continued.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Miss.R.—Cont'd.</i>						
New Orleans, La...	13.0		30	7.2	5	2.3
<i>Ohio River:</i>						
Pittsburgh, Pa.....	22.0		10	14.4	2	4.5
Parkersburg, W.Va....	38.0		26	19.5	3	8.1
Cincinnati, Ohio....	50.0		28	33.6	1	13.2
Louisville, Ky.....	25.0		28	12.9	1	6.0
<i>Cumberland River:</i>						
Nashville, Tenn....	40.0		19	24.7	5	4.1
<i>Tennessee River:</i>						
Chattanooga, Tenn....	33.0	11—21	11.3	1, 2	2.7	8.6
<i>Monongahela River:</i>						
Pittsburgh, Pa.....	29.0		10	14.4	2	4.5
<i>Savannah River:</i>						
Augusta, Ga.....	32.0		22	17.1	3—10	6.8
<i>Willamette River:</i>						
Portland, Oregon...	15.0	27, 28, 29	4.3	19	0.3	4.0

The Signal Service observer at Fort Sully, S. Dak., reports, under date of the 20th, that the water in the Missouri River at that place was lower than it had been at any time during the last eighteen years, and that navigation was suspended in consequence. At Chattanooga, Tenn., navigation was opened on the Tennessee River on the 4th, and driftwood was floating in the river on the 10th and 11th.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Well-defined auroral displays were noted at Fort Buford, N. Dak., on the 1st; at Moorhead, Minn., Marquette, Mich., Northfield, Vt., and Eastport Me., on the 17th; at Fort Buford, N. Dak., Eastport and Portland, Me., and Northfield, Vt., 26th.

Fort Buford, N. Dak.: an aurora was first observed at 12.08 a. m., 1st; it consisted of a well-defined arch of yellowish light, which rose to about altitude 45°, the centre of which extended over about 70° between the northwest and northeast; beneath the arch was a diffused gray light, covering the space between the horizon and the arch. The lower portion of the aurora was partly obscured by stratus clouds. The maximum intensity occurred at 1.46 a. m., after which the arch gradually disappeared, and at 2.22 a. m. the display had entirely vanished. Auroral streamers, rising to altitude 60°, were observed in the north and northeast between 10.05 p. m. and 10.52 p. m., the same date. Another auroral display occurred on the evening of the 26th. It was first observed at 10.08 p. m., and consisted of a feeble gray light in the form of an arch, the western portion of which was about 30° above the horizon, from which point it extended eastward in a gradual slope, covering about 130° of the horizon. The display lasted until dawn of the 27th.—*Report of A. Schneider, observer, Signal Corps.*

Moorhead, Minn.: a faint auroral display was observed at 8.30 p. m., 17th. It consisted of a steady white arch of light, extending from azimuth 170° to 220°; the altitude of which was about 15°. The aurora continued as described until daylight of the 18th.—*Report of S. L. Dosher, observer, Signal Corps.*

Marquette, Mich.: an aurora was observed at 7.30 p. m., 17th. It consisted of a pale white arch, extending from north-northwest to north-northeast, from which at 8.40 p. m. streamers rose to a height of about 50°. The display was of ordinary brilliancy and ended at 11 p. m.—*Report of Wm. H. Andy, observer, Signal Corps.*

Eastport, Me.: a faint auroral arch was observed a 7.45 p. m., 17th. It extended from northeast to a little west of north and to altitude 10°. The aurora extended farther westward and attained its maximum brilliancy at 9.30 p. m., when beams of light rose to near the zenith. At 9.50 p. m. the aurora consisted of a well-defined arch of altitude 15°, and had entirely disappeared at midnight. Another auroral arch of altitude 15° was observed at 5.30 p. m., 26th; it remained faint until

6.30 p. m., when it appeared to separate into two arches, the upper one having an altitude of 12° and the lower an altitude of 8°; the upper extending from northeast to northwest. At 6.35 p. m. the display was quite brilliant, and shafts of light were shooting up from all parts of the arch. At 8 p. m. the arch was well defined and attained an altitude of 30°, extending from east-northeast to northwest. The display ended at 11 p. m.—*Report of D. C. Murphy, observer, Signal Corps.*

Northfield, Vt.: a faint auroral display was observed at 7.45 p. m., 17th. It consisted of a white light extending from azimuth 180° to 225°. At 7.55 p. m. the light had moved towards the east, its position being then from azimuth 215° to 235° and altitude 15°, with occasional streamers which rose to about 30° above the horizon. The display ended at 9 p. m. Another auroral arch was observed between 7.30 p. m. and 9 p. m., 26th, its color being similar to the morning dawn. The arch extended from azimuth 135° to 225° and to altitude 35°, with numerous small clouds in the upper portion of the arch.—*Report of William Line, observer, Signal Corps.*

Portland, Me.: an auroral arch was observed at 7.45 p. m., 26th. The arch was moderately luminous and fairly defined; it extended from about azimuth 158° to 202° and to altitude 12°. The arch gradually faded away at about 9.30 p. m.—*Report of N. D. Lane, observer, Signal Corps.*

Auroras were observed during the month as follows: 1st, Fort Buford, Leech Farm, and New England City, N. Dak.; Webster, S. Dak. 2d, Egg Harbor City, N. J.; South Canisteo, N. Y. 5th, 6th, and 8th, Huron, S. Dak. 11th, Princeton, Ind. 14th, 15th, Webster, S. Dak. 16th, Cornish, Me.; Leech Farm, N. Dak.; Yaukton, S. Dak. 17th, Southington, Conn.; Leicester, Mass.; Cornish, Eastport, and Orono, Me.; Marquette, Mich.; Montevideo, Moorhead, and Pine River, Minn.; Glendive, Mont.; Spencerport and Wedgwood, N. Y.; Leech Farm and New England City, N. Dak.; Webster, S. Dak.; Northfield, Vt. 18th, Cornish, Me.; Montevideo, Minn.; Nashua, N. H.; Leech Farm, N. Dak. 19th, Ilion, N. Y. 20th, Farmington and Orono, Me. 21st, Orono, Me. 24th, Ozark, Mo. 25th, Orono, Me. 26th, Kootenai, Idaho; Eastport and Portland, Me.; Leicester and Newburyport, Mass.; Glendive, Mont.; Egg Harbor City, N. J.; Nashua, N. H.; Ardenia, Honey Mead Brook, and Queensbury, N. Y.; Fort Buford, N. Dak.; Huron, Kimball, and Wolsey, S. Dak.; Northfield, Vt.